

Northern Rockies Node for the National Biological Information Infrastructure

Plan submitted by

U.S. GEOLOGICAL SURVEY
Northern Rocky Mountain Science Center
Bozeman, Montana

And

MONTANA STATE UNIVERSITY
Bozeman, Montana

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Statement of Topic

Setting: The Northern Rockies Node is a regional node of the National Biological Information Infrastructure. Focusing on an area covered by the Rocky Mountain Range from Wyoming north into Canada, it includes the Greater Yellowstone Ecosystem and the area around Glacier National Park known as the Crown of the Continent. This region contains extensive National Forests, National Parks, and other public lands. There is ongoing, lively debate about the use of public lands in the region, associated with the shift from commodity extraction and agricultural uses to tourism, recreation, and correlated growth in the service sectors (Clark, T.W. and Minta, S.C. 1994. Greater Yellowstone's Future. Homestead Publishing, Moose, WY. 160 pp.). While the economy and patterns of land use are changing in the region, natural forces also are at work. Among them are changes in climate, invasions of noxious weeds and other exotic species, increases or decreases in native wildlife and plants, intensity of wildfires, and variability in surface water and groundwater supplies.

Node focus: The Northern Rockies Node will provide access to scientific information about biological and other natural resources on public lands in the region, in the context of natural forces and changing land use patterns. The goal of this effort is to develop an information resource that will be useful to Federal, state, and local agencies, universities, non-governmental entities, and the general public in addressing issues concerning management of public lands. In addition to increasing the utility of both historical and newly collected data, we will provide decision support tools and systems to address specific management and science needs of our partners and clients. Through discussions with clients (including computer supported cooperative work methodologies), specific management questions will be targeted for decision support.

General Background

Purpose of NBII: The National Biological Information Infrastructure (NBII) is part of a broader effort to develop a National Information Infrastructure. The NBII is the biological component of this infrastructure, serving as an electronic gateway to biological data and information products maintained by Federal, state, and local government agencies, non-governmental institutions, and private-sector organizations. Development of NBII is being pursued through development of a system of regional, thematic, and infrastructure “nodes.” Regional nodes are intended to involve local data users, data collectors, and owners in the process. They allow people close to the issues and the partner groups to form active coalitions in addressing biological issues. Finally, they facilitate sharing of expertise, resources, and information through a “seamless” network.

Value added: The Node will be developed as an actual and virtual meeting place to work toward solutions to resource management challenges for public lands in the Northern Rockies. Academic institutions, non-governmental organizations, and government agencies all conduct scientific investigations that are relevant to the management of natural resources on these lands. Currently, there are many ongoing efforts in the area to assemble and use spatial data along with other ecological knowledge to address such issues. We will facilitate access to this information and work with those who generate and use it to provide decision support tools and systems to optimize its use. By tapping the landscape ecology, remote sensing, and decision analysis expertise of scientists in the region, we can integrate significant scientific knowledge across many disciplines to address the needs for information to better support management of public lands.

Initial objectives: In the first year (FY 2001), establishment of the Northern Rockies Node will focus on development of selected data sets and web-based tools that address readily identifiable needs of natural resource managers and the scientific community in the region. These include regional climate data, metadata for diverse sets of data related to the Greater Yellowstone Area, and digital maps that provide a spatial context for the data. As partnerships are developed and stakeholder needs become better defined, the Node will expand to provide access to a wider range of data, analytical tools, and decision support functions. Even though numerous scientific studies have resulted in large amounts of data, often they are difficult to access. Currently no central site provides access to spatial, geological, ecological, and water-related data and information in this region. In time, the Node should develop into a distributed system with links to a wide range of these scientific information resources.

Design of the Node

The Node is being designed to provide easy access to authoritative scientific information concerning natural resources on public lands, to help support better decisions by resource managers and others. Plans for building the Node include further research into the cause and effect relationships that determine the condition of wildlife and other resources on public lands in the Northern Rockies, and development of predictive models that can be

accessed through the Node to explore potential outcomes of future resource management options. We recognize that data have little value of their own accord to resource managers, biologists, and researchers. Data and information must be transformed into knowledge by processing, analysis, modeling, and visualization if they are to become useful.

The Node will be developed and administered with a three-tiered design: *infrastructure*, *integrated architecture*, and *user gateway* (Figure 1).

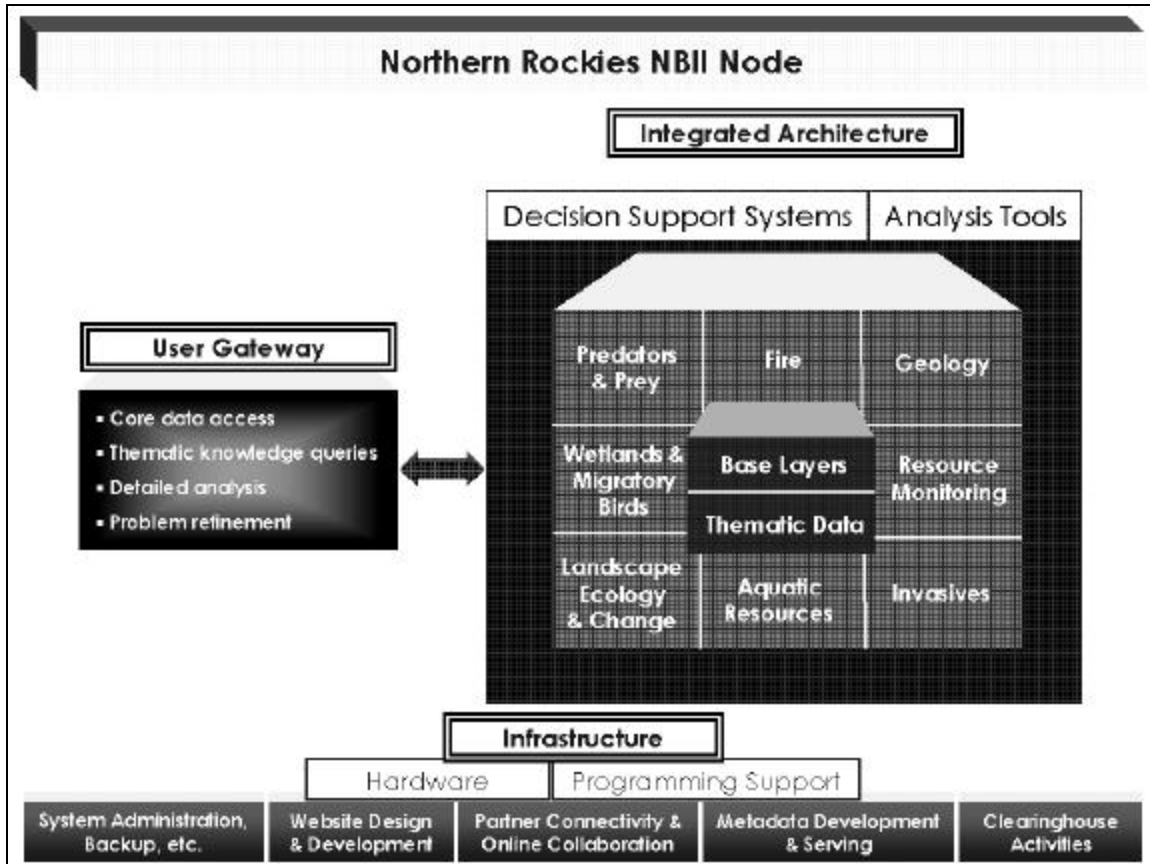


Figure 1. Structure of the Northern Rockies Node.

Infrastructure: Developing the infrastructure for the Node will include:

- Activities for partner and client connectivity and online collaboration
- Metadata development and serving
- Website design and development
- Clearinghouse activities
- System administration

Programming capabilities needed for Node development will be substantial. We will focus on integrating technical resources among USGS disciplines and our partners to

meet these programming needs. We will use a systems analysis approach to develop an assessment of needs for hardware and software.

Integrated architecture: The integrated architecture will be oriented towards development of decision support systems and analysis tools that use data, knowledge, and models across USGS disciplines. A decision support system is an interactive, computer-based tool that uses information and models to improve the process and outcome of decision making. Such systems use a structured approach to assist managers in refining their problems and posing answerable questions. Correspondingly, analysis tools provide the functionality to address explicit questions with specific data and information. These tools typically form part of the foundation of decision support systems, which require that problem refinement be addressed as a first step. The architecture of the Node is designed to reduce uncertainty faced by managers by helping them evaluate appropriate alternatives through decision support systems. Data visualization, models and analytical tools, and interactive web-based mapping are among the additional features that will be developed to access and use information through the Node.

To support decisions and analytical needs for management of public lands in the Northern Rockies, a number of resource themes will be emphasized, including:

- Status and ecology of living resources, including wildlife and plants
- Landscape ecology and climate change
- Fire ecology
- Invasive species
- Wetlands and water resources
- Earth surface processes and their ecological consequences (e.g., hazard assessment, geothermal resources, and coal bed methane extraction)

Base layers and thematic data make up the core of the Node. These elements will provide contiguous geospatial data at high spatial and temporal resolutions. Included will be data related to climate, hydrology, geology, administrative units, botany, wildlife, land use, terrain, socio-economics, etc. The core also will include information and knowledge bases related to these specific themes. Metadata will be developed concurrently with data to be served.

Collaboration with partners and clients is essential for successful development of the Node. Understanding their explicit needs is crucial. By engaging them in development of the Node both formally and scientifically, we will address issues and topics important to them and better understand the decisions that need support. Collaborator workshops will be conducted to activate a dialogue and gather input from both our partners and clients; online collaborative tools will be put in place to continue the dialogue.

User gateway: Access to the Node will be provided by a user gateway consisting of graphical user interfaces to access core data, generate thematic knowledge queries, carry out detailed analyses, and assist in problem refinement. Gateway accessibility will be targeted primarily to the needs of specific clients, and secondarily to all other interested

parties. This affords the capability to use the information online, download needed data layers, and use models and decision support systems. The ability to access and search metadata will be addressed because it is important to scientific users that documentation of data standards and quality be available.

Specific Activities for Development of Prototype and Timetable of Milestones

Year one (FY 2001): The Node will be launched as soon as basic functions are established. The Node will be populated with currently available data and information including FGDC compliant metadata. We will hold one or more workshops to identify the management decisions upon which to focus our decision support activities. This will include determining ways to foster further online discussions and collaboration.

Infrastructure activities will include:

- Securing programming and system administration capability
- Designing the website
- Completing a hardware and software systems analysis, in collaboration with the Rocky Mountain Geographic Science Center
- Compiling and serving metadata and data
- Developing the capability to use computer supported cooperative work methodology for online collaboration

Integrated architecture activities will include:

- Holding one or more initial stakeholder workshops and producing written reports of results
- Serving metadata for the Greater Yellowstone Area that were developed by the Geographic Information and Analysis Center for USGS
- Assembling and serving regional climate data and models
- Assembling and serving an extensive trumpeter swan neck collar database
- Identifying and building links to data sets maintained by partners, including the Montana University System Water Center (<http://water.montana.edu>), Montana State Library Natural Resources Information System (<http://nris.state.mt.us>), and the Montana State University Geographic Information and Analysis Center (including links to the Digital Atlas of the Greater Yellowstone Area and to the Greater Yellowstone Area Data Clearinghouse) (<http://sun1.giac.montana.edu/giac.html>).
- Developing relationships and plans for serving information products related to wildfires and invasive species in partnership with the U.S. Forest Service Rocky Mountain Research Station, the USGS EROS Data Center, and the State of Montana's Center for Invasive Plant Management (<http://www.weedcenter.org>). Initially, the Node will focus on serving products of a post-fire burn assessment by remote sensing on National Park Service lands, being developed by USGS and USFS with partial support from USGS Venture Capital funding.

Preliminary discussions with partners and clients in developing this plan for the Node led to the identification of opportunities for initial products that would be widely regarded as useful by stakeholders in the region:

- These include climate information, which is basic to the understanding of changes in plant communities, wildlife, water resources, and wildfire. Development of such information, both data and models for their interpretation, will support a wide range of applications in science, education, and natural resource management.
- The other immediate opportunity for development is to serve a regional database on mark-resighting of trumpeter swans that has been compiled by state and Federal agencies, including the National Park Service and U.S. Fish and Wildlife Service. The species is of special concern in the Northern Rockies, and it is the focus of extensive conservation efforts by Yellowstone National Park and others within the flyway. By compiling and serving the swan database, the Node will provide an immediate service to resource management agencies that need access to current information on swan population changes as a basis for management actions.

User gateway activities will center on basic website design and capability for core data and metadata access, in consultation with the Burns Telecommunications Center (<http://btc.montana.edu>) and other Montana State University partners.

Year two (FY 2002): The Node will be populated with additional data as they and related metadata become available. Based on the workshop(s) of year one and subsequent discussions, we will begin to develop appropriate analytical tools. Additional workshops will be held with partners and clients to help assess the need for midcourse correction. Hardware and software procurements will be made. Also during year two, prototype outreach products of the Node will be developed and tested in partnership with the Big Sky Institute for Science and Natural History (<http://bsi.montana.edu>).

Year three (FY 2003): Work will focus on development of decision support tools based on predictive models, following rapid prototyping methods. We will pursue additional opportunities for interdisciplinary approaches across USGS. Access to data, metadata, and tools - including the application of remote sensing and spatial modeling – will be provided to address specific resource management needs. Outreach products based on tested prototypes will be deployed through the Burns Telecommunications Center and National Park Service Learning Centers in the Northern Rockies. Computer kiosks are envisioned as outreach tools at National Park Visitor Centers in the region. Incorporation of Node tools into course curricula will be explored with universities and community colleges in Montana and Wyoming.

Budget and Staff Required to Achieve Tasks

FY2001 Needs:

Item	Funding (\$K)	Lead*	Quarter Completed
<i>Infrastructure</i>			
Programming support for website design and data analyses (contract from NRMSC to MSU)	45.0	NRMSC	3 rd - 4 th
Systems analysis of hardware and software needs (informal analysis performed by RMGSC but thorough analysis will require contract for specialist to conduct assessment)	0 (15.0 unfunded**)	NRMSC	4 th
Data management support in partnership with RMGSC (\$40K match provided by USGS Associate Director – Geography)	25.0	NRMSC	3 rd
<i>Integrated Architecture</i>			
Workshop(s) with stakeholders	5.0 (10.0 unfunded)	NRMSC	4 th
Development of climate data and associated models	20.0	NRMSC	4 th
Trumpeter swan mark-resight database management (mainly one-time expense to edit and compile in digital format)	25.0	MSU	4 th
<i>User Gateway</i>			
Programming support	15.0	MSU	3 rd - 4 th
Total	135.0 (25.0 unfunded)		

*Lead roles on specific activities will be determined by the Northern Rockies Node Steering Committee. USGS appropriated funds for the Node are to be managed by NRMSC, and a portion of them will be transferred to MSU for specific tasks through the Cooperative Agreement between USGS and MSU.

**Funding for FY 2001 is less than anticipated; supplemental funds are requested from the Biological Information Management and Delivery Program. NRMSC has no base funding in that program element to support Node infrastructure.

FY2002 Needs:

Item	Funding (\$K)	Lead*	Quarter Completed
<i>Infrastructure</i>			
Programming Support	200.0	NRMSC	1 st - 4 th
Metadata Compilation	150.0	MSU	4 th
Computer Supported Cooperative Work	50.0	MSU	4 th
Systems Administration & Development	220.0	NRMSC	1 st - 4 th
<i>Integrated Architecture</i>			
Workshops with stakeholders	15.0	NRMSC	4 th
Fire Ecology Information in partnership with USFS and Montana University System	200.0	NRMSC	4 th
Climate Models	150.0	MSU	3 rd
Trumpeter swan DSS	80.0	MSU	3 rd
Grizzly Bear DSS	120.0	NRMSC	4 th
Earth Surface Process Models	100.0	MSU	4 th
Other Database Development	90.0	NRMSC	4 th
<i>User Gateway</i>			
Programming support	40.0	NRMSC	1 st - 4 th
Computer Supported Cooperative Work	25.0	MSU	3 rd
Workshop	10.0	MSU	3 rd
Systems Administration & Development	50.0	NRMSC	1 st - 4 th
Total	1500.0		

*Lead roles on specific activities will be determined by the Northern Rockies Node Steering Committee. USGS appropriated funds for the Node are to be managed by NRMSC, and transferred to MSU for specific tasks through the Cooperative Agreement between USGS and MSU.

FY2003 Needs: The details of our FY2003 budget will be depend on specific input from partners and clients. Funding needs are anticipated to be at the FY2002 level.

Partners Involved and their Roles

Joint venture of MSU and NRMSC: The Northern Rockies Node is being developed as a joint venture of Montana State University and the Northern Rocky Mountain Science Center. Guidance for development of the Node will be provided by a Steering Committee composed of directors of key MSU centers and departments and NRMSC. Recognizing the importance of a Federal science presence in this region, the U.S. Geological Survey (USGS) established the Center in January 2000 to conduct integrated, interdisciplinary research in support of natural resource management in the Northern Rocky Mountains. Each of the four major scientific disciplines of the USGS (biology,

geology, hydrology, and geography) is involved. This interdisciplinary approach is enhanced by scientific collaboration with faculty of Montana State University. The existing memorandum of understanding between Montana State University and USGS will allow sharing of facilities, network capability, expertise, and collaborative funding with few additional administrative constraints. It is expected that Montana State University will involve undergraduate and graduate students in development of the Node, both in technical support and in conducting research and development as part of the requirements for advanced degrees in Earth Sciences, Ecology, and other fields.

Key partners: The Northern Rocky Mountain Science Center and the Rocky Mountain Geographic Science Center of USGS have formed a partnership to pursue geographic science, and to share capabilities for data management, information technology, web site hosting, and GIS development. RMGSC is stationing staff at NRMSC to conduct work as part of this integrated science effort. They will participate in development of the Node through facilitation of partnerships with data providers, GIS technology, computer support, and data management. Collaboration on the Node will be pursued as a high priority with Federal and state land management agencies including the National Park Service (particularly the Yellowstone National Park Center for Resources and Glacier National Park), U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, Montana Department of Fish, Wildlife and Parks, Wyoming Game and Fish Department, and Idaho Department of Game and Fish. Collaboration will be extended to other state natural resource agencies, county governments, and non-federal entities, as well other universities in the region. Natural resource-based private industries will be sought as partners in developing the Node. The broad, complimentary missions of MSU and USGS will facilitate the development of partnerships with diverse agencies and institutions. Some of the key partners and their potential roles are identified in the following table.

Partner	Management	Data	IT*	IS*	Education	User*
Geographic Information and Analysis Center	X	X	X	X	X	
Mountain Research Center				X	X	
Montana University System Water Center	X	X				
Big Sky Institute for Science and Natural History					X	
Burns Telecommunications Center			X		X	
Montana State Library Natural Resources Information System	X	X				
Rocky Mountain Geographic Science Center	X	X	X	X		
Yellowstone National Park Center for Resources		X			X	X
Glacier National Park		X			X	X
U.S. Fish and Wildlife Service refuges		X				X
Montana Fish, Wildlife and Parks		X				X

*Data = Producer or caretaker of scientific data

IT = Information technology

IS = Information science

User = Users for science or decision making

Leaders of Major Components

Organization and development of the Node will be guided by a Steering Committee composed of leaders representing the major partners.

Dr. Richard L. Jachowski, Director

Northern Rocky Mountain Science Center

USDI – Geological Survey

Biographical information: <http://nrmc.usgs.gov/staff/jachowski.html>

Dr. Richard Aspinall, Director
 Geographic Information and Analysis Center
 Montana State University
 Biographical information: <http://www.montana.edu/wwwes/text/geogfac.htm#RA>

Dr. Lisa J. Graumlich, Director
 Mountain Research Center
 Montana State University
 Biographical information: <http://mountains.montana.edu/people/lisa>

Dr. Gretchen Rupp, Director
 Montana University System Water Center
 Biographical information: http://water.montana.edu/mw_partners/gr-vita.rtf

Executive Director (currently vacant)
 Big Sky Institute for Science and Natural History
 Montana State University
 Vacancy announcement: <http://www.montana.edu/msuinfo/jobs/prof/sn212-1.htm>

Dr. Daniel Goodman, Director
 Environmental Statistics Group, Department of Ecology
 Montana State University
 Biographical information: <http://www.montana.edu/ecology/faculty.html>

Ms. Kim Obbink, Director
 Burns Telecommunications Center
 Montana State University
 Biographical information: <http://btc.montana.edu/about/staff.htm>

General Issues

Relationship to other information services: The Node will complement, rather than duplicate, a wide range of efforts by agencies and institutions to serve regional information through geographic information systems. While planning and developing the Node, we will remain in close contact with operators of the University of Wyoming's Spatial Data and Visualization Center (<http://www.sdvc.uwyo.edu>) and the Montana State Library Natural Resource Information System (NRIS) to avoid duplication and to foster complementary development. Each of these web sites serves spatial data but with different geographic extents and purposes, with the Node emphasizing decision support for management of natural resources on public lands, using data integrated across scientific disciplines. The Node will cover multiple states, including links to providers of single-state data.

Links with other nodes: Architecture of the Northern Rockies Node will be developed in consultation with teams responsible for other geographic nodes to share ideas and

approaches to building functions. This includes methods for managing and delivering geospatial information. Development of information content and utilities related to subject matter served by thematic nodes will be coordinated with teams responsible for those nodes, including the Fisheries and Aquatic Resources Node and the Migratory Bird Population and Habitat Data Center Node.